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An das
Europäische Patentamt

80298 München

March 5, 2004

European Patent Application No.: PCT/EP02/02518
Applicant: NOKIA CORPORATION
Our ref: WO 28634 (Frist: 15.3. Eing.)

In response to the Written Opinion dated December 15, 2003.

1.) Attached are submitted claims 1 to 21. It is respectfully requested to base the further international preliminary examination proceedings on these attached claims 1 to 21.

2.) New claim 1 is essentially based on original claims 1, 7, and 10.

New dependent claim 2 is based on the description on the originally filed application page 11, lines 27 to 35.

New dependent device claims 3 to 12 are based on original claims 2 to 6, 8, 9, and 11 to 13.

New independent method claim 13 is based on original claim 14 and has been amended similar to the above discussed amendments of claim 1.

New dependent method claim 14 corresponds to new device claim 2.

New method claims 15 to 21 are based on original claims 15 to 19, 21, and 22.

3.) According to the claimed subject-matter of independent claims 1, 13, a power control loop is provided which contains a detector means for detecting the output of the power amplifier. The detection of the amplifier output is controlled, by the control means, so as to be performed only during the time of output of a training sequence. The power is then controlled based on the output power detected at the time of occurrence of the training sequence.

The proposed power control concept provides a good and reliable as well as quick power control.

4.) Reference D1, EP-A-461314, discloses an amplitude control system for an active antenna array. A power detector generates a power level signal representative of the radio frequency energy level radiated by one or more antenna elements in an antenna array. The generated power level signal is compared with a reference signal which corresponds to a desired value for the radiated level of the RF energy and is set by a control device. An attenuator associated with the RF amplifier driving the antenna elements, is adjusted in such a manner that the radiated RF energy is maintained at the desired value set by the control device.

Reference D1 is silent with regard to any "training sequence". Hence, reference D1 cannot render obvious or disclose the claimed subject-matter.

The Written Opinion referred, with regard to the feature "training sequence", to the abstract of reference D1. However, the reference signal R mentioned there appears to represent the command set value for comparison, that is the desired value of the radiated level of RF energy.

Contrary thereto, the training sequence of the claimed subject-matter is part of the received or transmitted signal to be measured, and not part of a command signal representing a desired value.

Hence, the feature of using only the training sequence for detecting the output of the power amplifier, and using only this part of the antenna signal for power control, is a novel and inventive feature which is neither mentioned nor rendered obvious by reference D1.

It is hence respectfully requested to issue an IPER confirming novelty and inventive step of the claimed subject-matter of attached claims 1 to 21.

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Enclosure:
- Claims 1 to 21

CLAIMS 1 to 21

1. Power control device for calibrating the power of a transmitter or receiver in a mobile communication network comprising an antenna array (40), the device being adapted to transmit or receive burst signals to the antenna array (40) which burst signals include a fixed training sequence (10), the transmitter or receiver comprising a power amplifier (2), and the power control device comprising

a calibration means for calibrating the transmission or receiving power of the transmitter or receiver, the calibrating means including a summing means (74) connected to the antenna array (40) for summing transmission or reception signals, and a common calibrating device for calibrating the summed signals, and

a power control loop (14, 17 to 23) for controlling the output power of the power amplifier (2), the power control loop containing a detector means (19) for detecting the output of the power amplifier, and a control means (23) for controlling the detector means (19) so as to detect the output of the power amplifier (2) only during the time of output of the training sequence (10),

wherein the device is adapted to control the power based on the detected output power.

2. Device according to claim 1, wherein the control means (23) is adapted to issue a control signal which is applied to a control input of the detector means (19), the control means (23) being adapted to generate the control signal with a timing so as to operate the detector means (19) only when the power amplifier (2) outputs the fixed training sequence (10).

3. Device according to claim 1 or 2, comprising a transmission branch and a reception branch, and a first switch means (70) for switching the connection of the summing means (74) either to the transmission branch or to the reception branch.

4. Device according to claim 3, comprising a second switch means (69) for switching the connection of the transmission branch either to the summing means (74) or first switch means (70), or to a reference coupler (72) for supplying a reference signal to the transmission branch.

5. Device according to claim 3 or 4, comprising a further switch means (64) provided in the transmission branch for temporarily blanking the transmission branch.

6. Device according to any one of the preceding claims, wherein the device is adapted to measure, for transmit calibration (Tx calibration), idle timeslots with only one column active.

7. Device according to any one of the preceding claims, wherein for receive calibration, a dummy burst is generated and modulated onto a carrier, the dummy burst is received in each branch of a transmitter, and the amplitude and phase differences between each path are measured and used as a new receive calibration offset.

8. Device according to any one of the preceding claims, comprising a chipset of a mobile terminal which is used for calibration.

9. Device according to any one of the preceding claims, comprising a passive coupling network in the antenna array

and a calibration board which works at radio frequencies.

10. Device according to any one of the preceding claims, comprising an open loop static power control for controlling the output power of a power amplifier, wherein the open loop static power control comprises a controllable attenuator means arranged upstream of the input side of the power amplifier, the controllable attenuator means being controlled by a control means of the device.

11. Device according to any one of the preceding claims, which is adapted to set the output power on the basis of information measured in a previous timeslot and no power corrections are made during a measured timeslot.

12. Device according to any one of the preceding claims, for application in a smart antenna structure comprising several antennas, including a power amplifier in each antenna path, a common attenuator, and a splitter arranged between the common attenuator and the antenna pathes, each power amplifier including a power control loop.

13. Power control method for calibrating the power of a transmitter or receiver in a mobile communication network comprising an antenna array, wherein burst signals are transmitted to, or received by, the antenna array which burst signals include a fixed training sequence (10), the transmitter or receiver comprising a power amplifier (2), comprising a calibration step for calibrating the transmission or receiving power of the transmitter or receiver, the calibrating step including a summing step for summing transmission or reception signals of the antenna array, and a common calibrating step for commonly calibrating the summed signals,

the output power of the power amplifier (2) being

controlled by a power control loop (14, 17 to 23) which includes a detector means (19) for detecting the output of the power amplifier, and a control means (23) for controlling the detector means (19) so as to detect the output of the power amplifier (2) only during the time of output of the training sequence (10),

wherein the power is controlled based on the detected output power.

14. Method according to claim 13, wherein the control means (23) issues a control signal which is applied to a control input of the detector means (19), the control means (23) generating the control signal with a timing so as to operate the detector means (19) only when the power amplifier (2) outputs the fixed training sequence (10).

15. Method according to claim 13 or 14, comprising a transmission branch and a reception branch, and a first switch means (70) for switching the connection of a summing means (74) performing the summing step either to the transmission branch or to the reception branch.

16. Method according to claim 15, comprising a second switch means (69) for switching the connection of the transmission branch either to the summing means (74) or first switch means, or to a reference coupler (72) for supplying a reference signal to the transmission branch.

17. Method according to claim 15 or 16, comprising a blanking step for temporarily blanking the transmission branch.

18. Method according to any one of the preceding method claims, wherein, for transmit calibration (Tx calibration), idle timeslots are measured with only one column active.

19. Method according to any one of the preceding method claims, wherein for receive calibration, a dummy burst is generated and modulated onto a carrier, the dummy burst is received in each branch of a transmitter, and the amplitude and phase differences between each path are measured and used as a new receive calibration offset.

20. Method according to any one of the preceding method claims, wherein the output power is set on the basis of information measured in a previous timeslot and no power corrections are made during a measured timeslot.

21. Method according to any one of the preceding method claims, for application in a smart antenna structure comprising several antennas, including a power amplifier in each antenna path, a common attenuator, and a splitter arranged between the common attenuator and the antenna paths, each power amplifier including a power control loop.